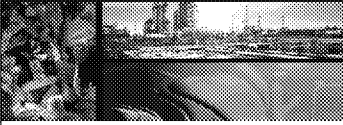


Quendall STAR PDE Overview

- **PDE Overview**
- **PDE Results**
- **Additional Drilling Investigation**
- **Recommendations for Full-Scale STAR**



PDE Overview



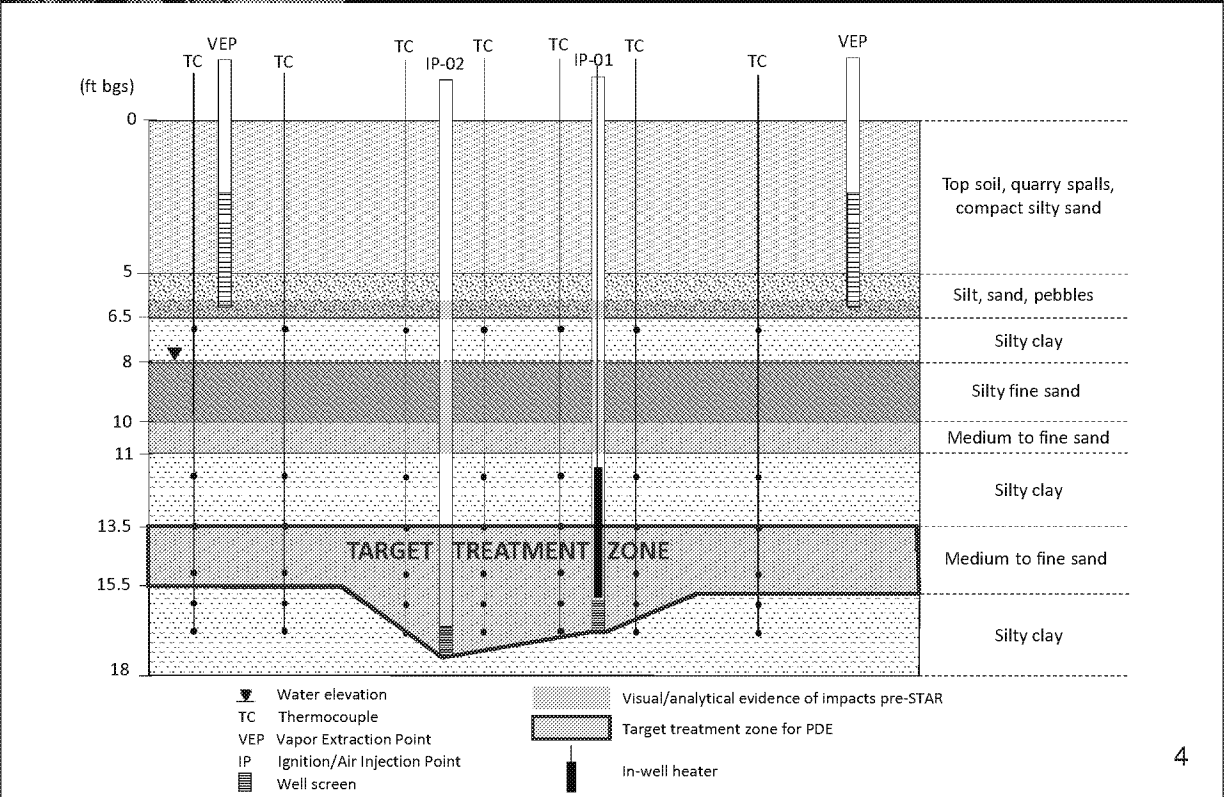


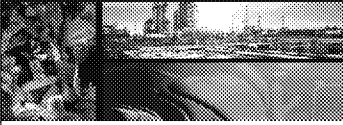
PDE Overview



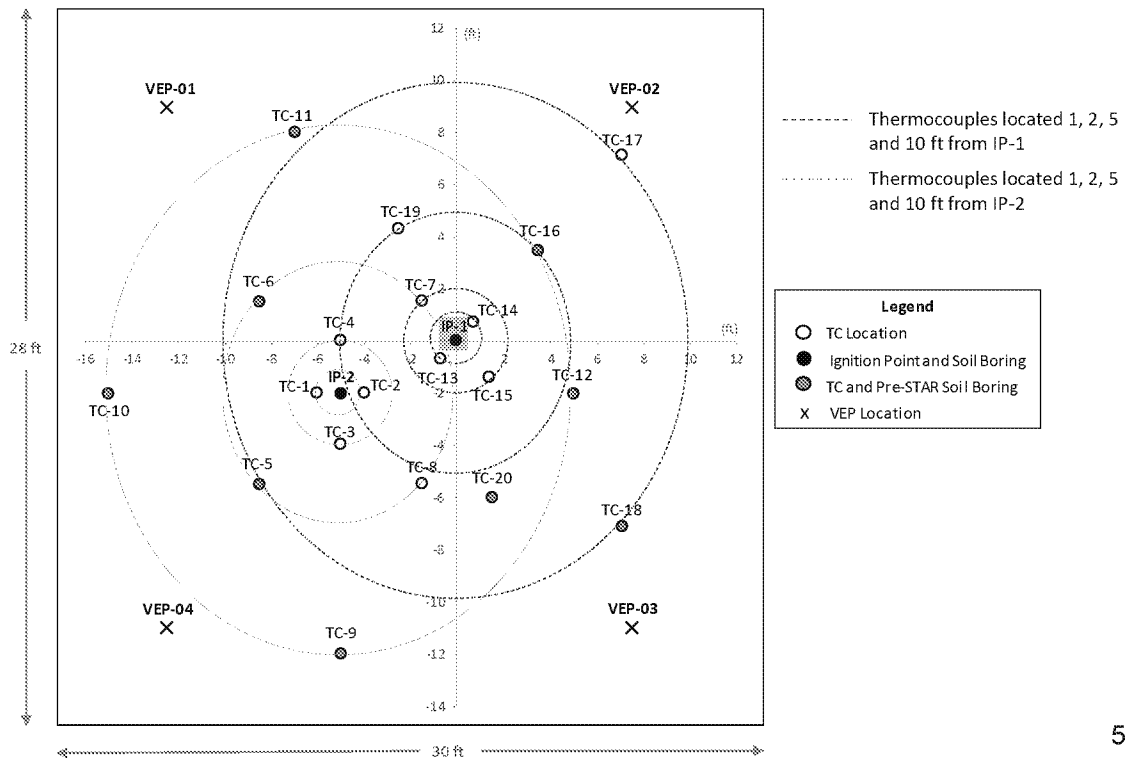


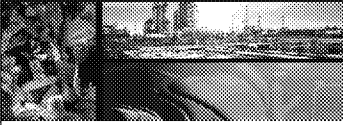
PDE Overview





PDE Results – IP-1

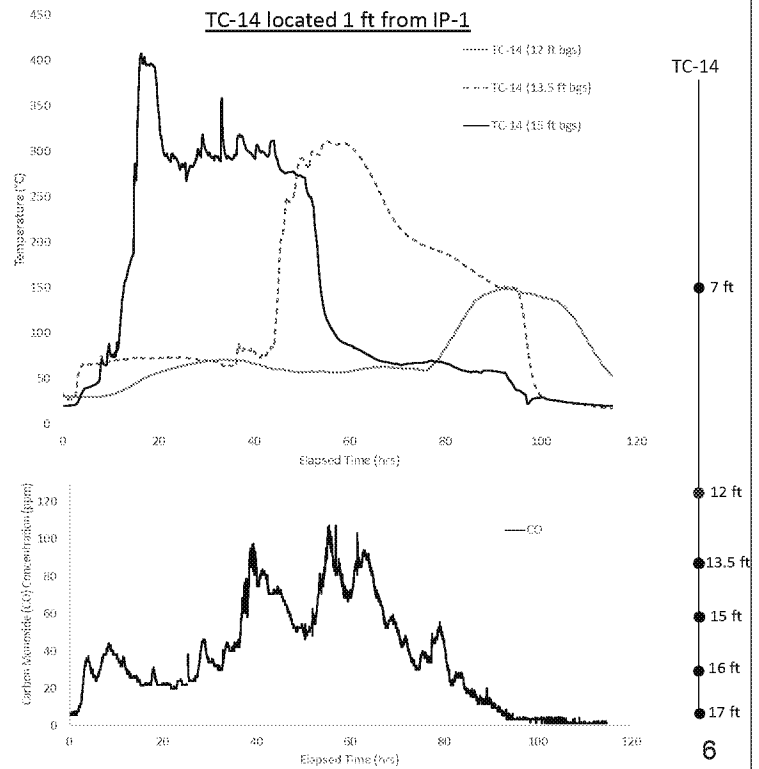
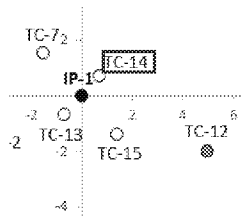


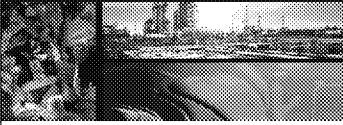


PDE Results – IP-1

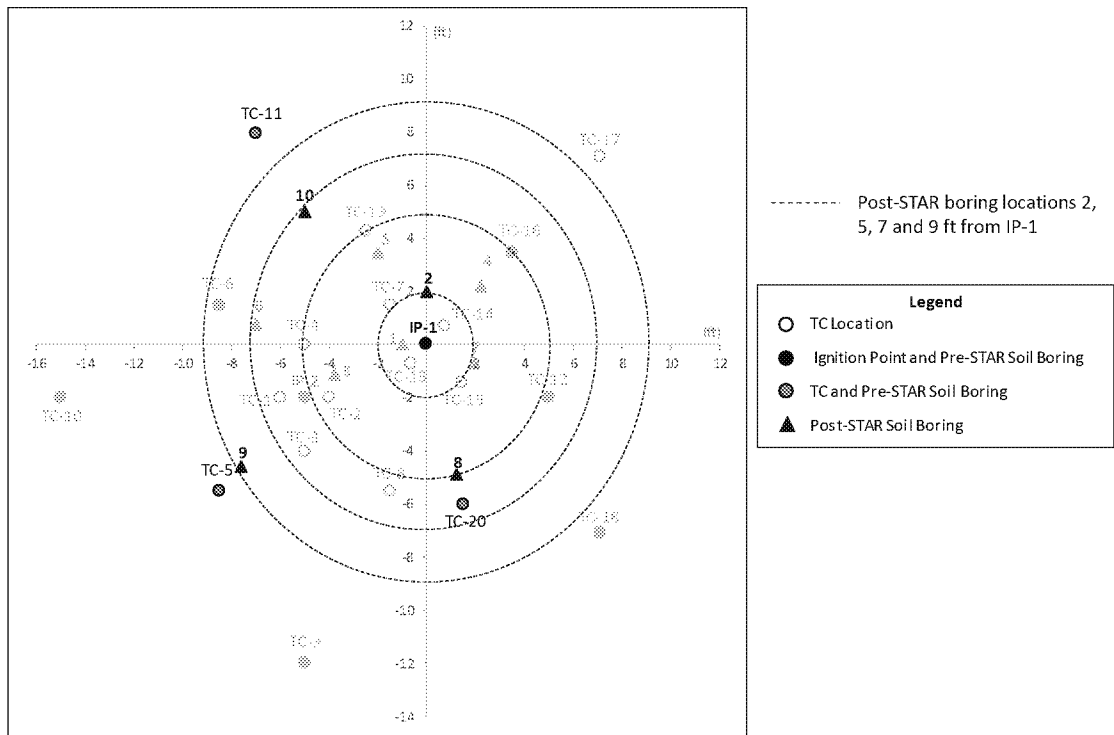
IP-1 Test

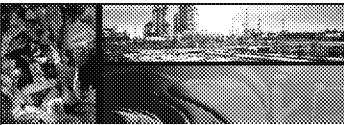
- Successful ignition and self-sustaining combustion
- Operated for 115 hours (~5 days)
- Reached ROI when CO concentrations returned to background levels



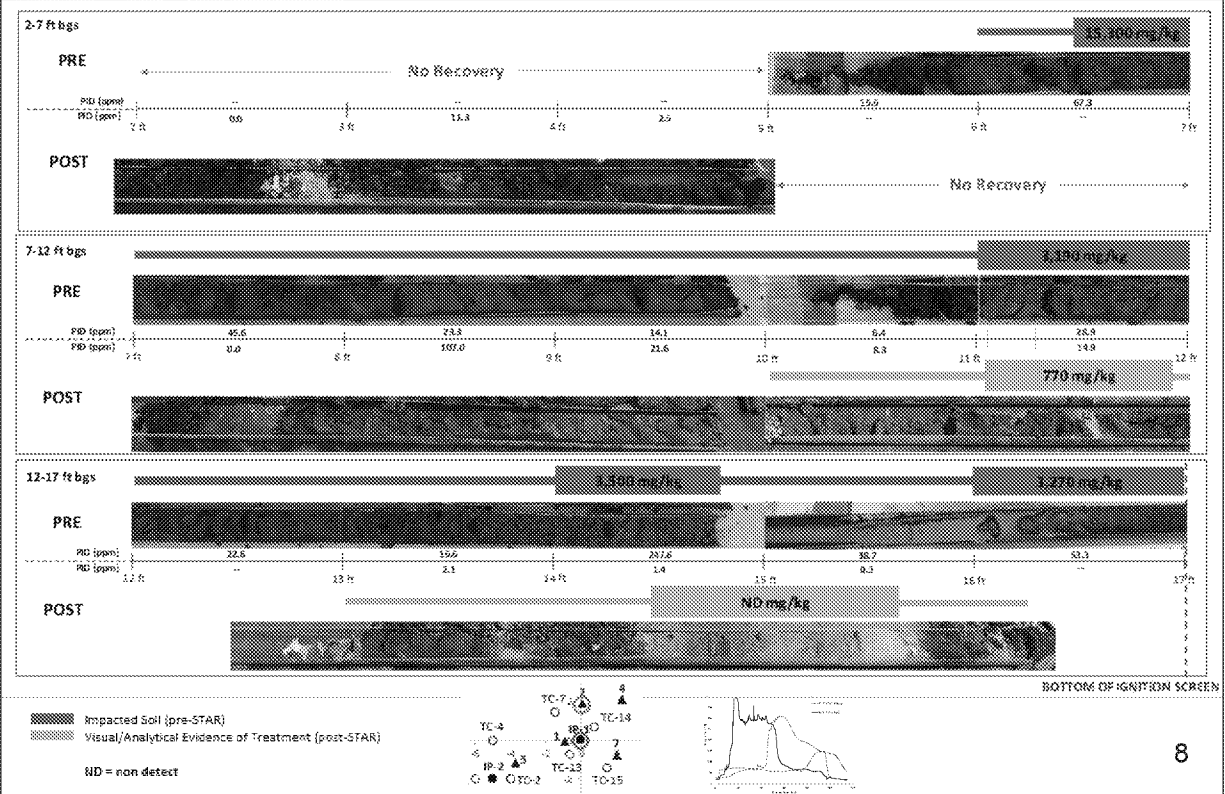


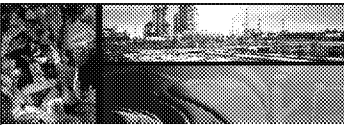
PDE Results



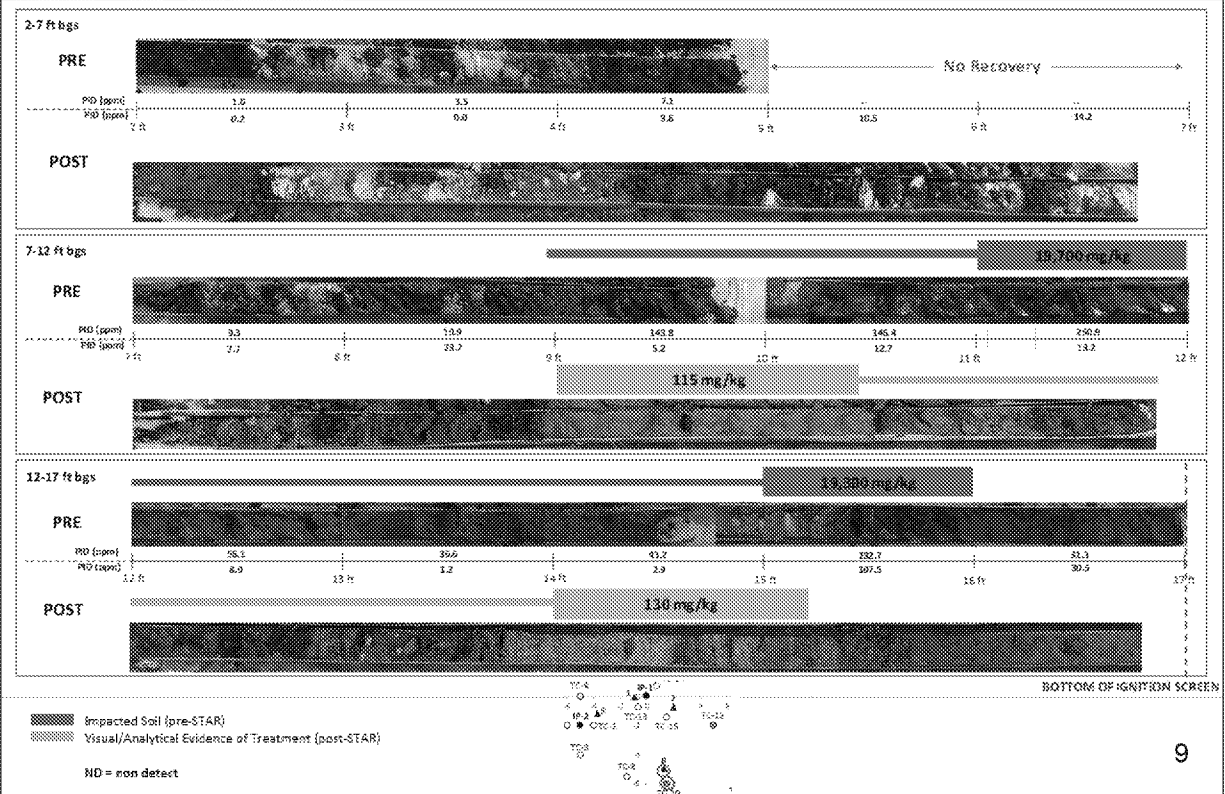


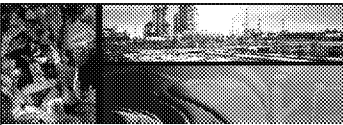
PDE Results (2 ft from IP-1)



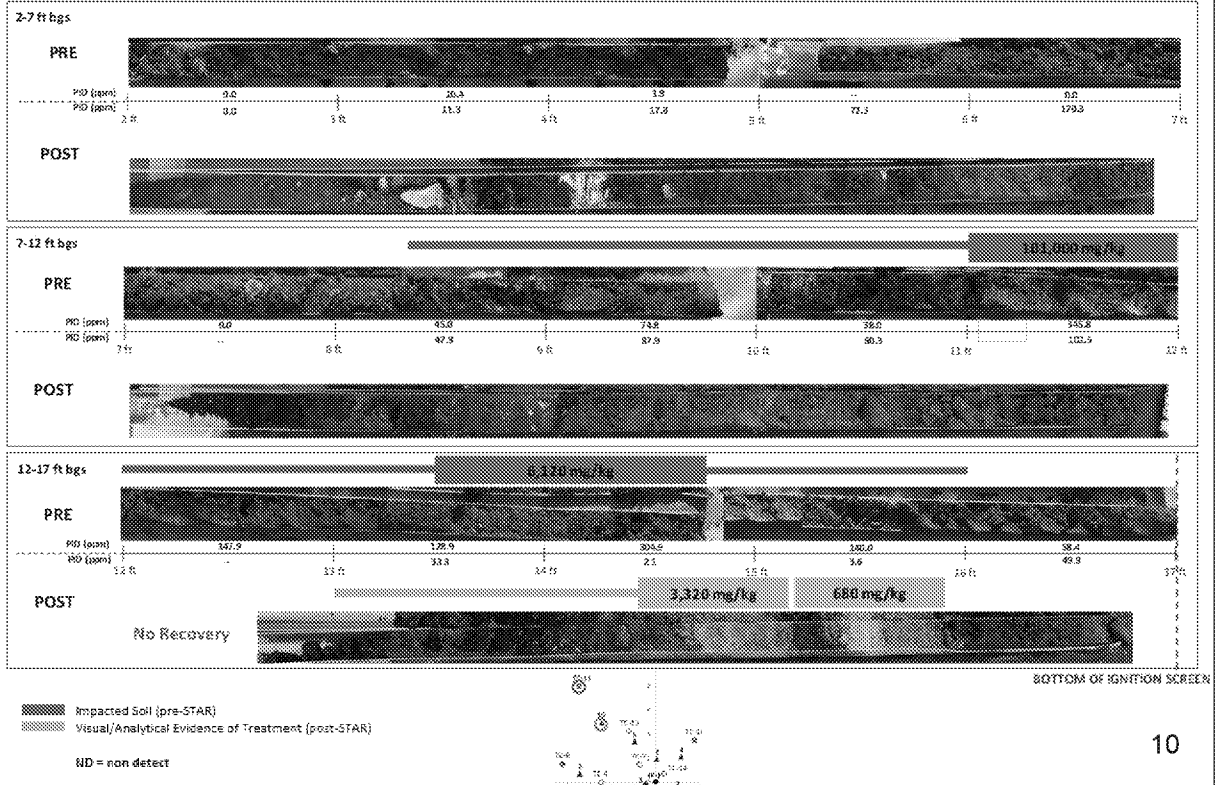


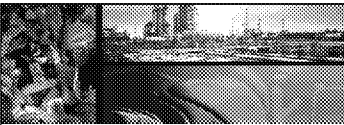
PDE Results (5 ft from IP-1)



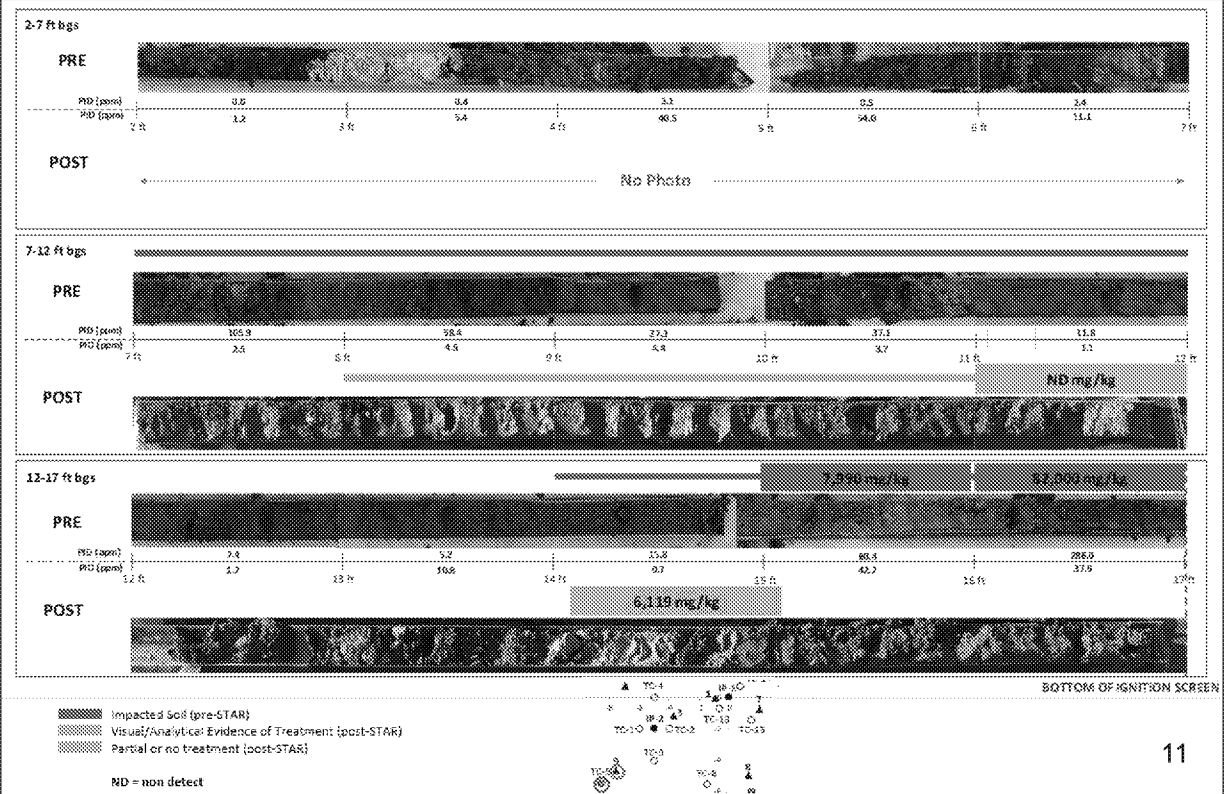


PDE Results (7 ft from IP-1)





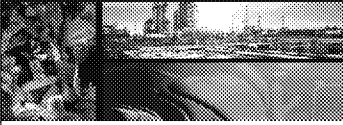
PDE Results (9 ft from IP-1)





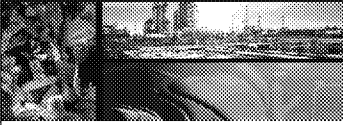
PDE Results - Summary

| | STAR Treatment |
|-------------------------------|----------------|
| Radius of Influence (ROI) | 7 ft |
| Treatment Zone Thickness | ~ 7 ft |
| Propagation Rate | 1.4 ft/day |
| [TPH] Reductions (within ROI) | 73% to >99% |
| [TPH] Reductions (at ROI) | 62% to 92% |



Additional Investigation: QP-1 Area

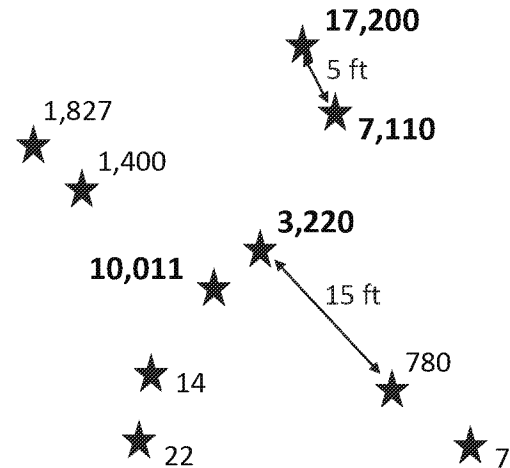


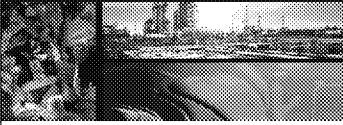


QP-1 Area

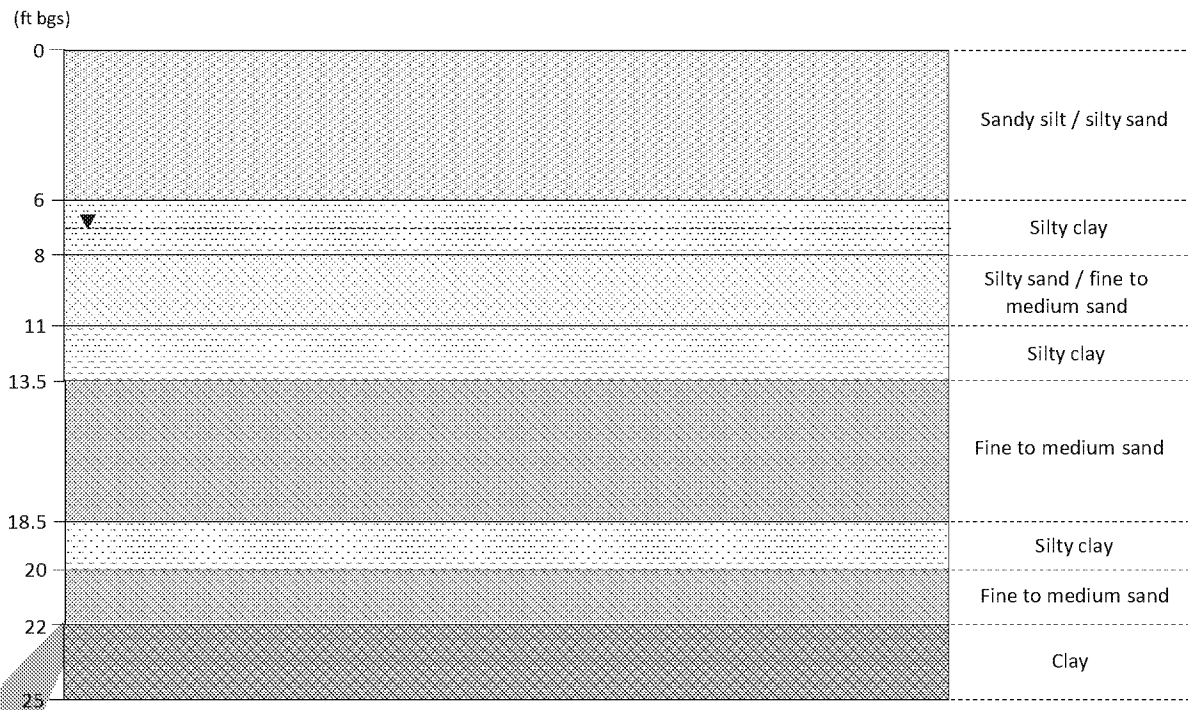
- 10 locations sampled
- Significant spatial variability in contaminant concentrations
- 40% of locations contain sufficient TPH concentrations
- Fewer low permeability layers

Maximum Total TPH Concentrations (mg/kg)





QP-1 Area



savron solutions.com



Visual/analytical evidence of impacts amenable to STAR



Additional Investigation: MC-1 Area

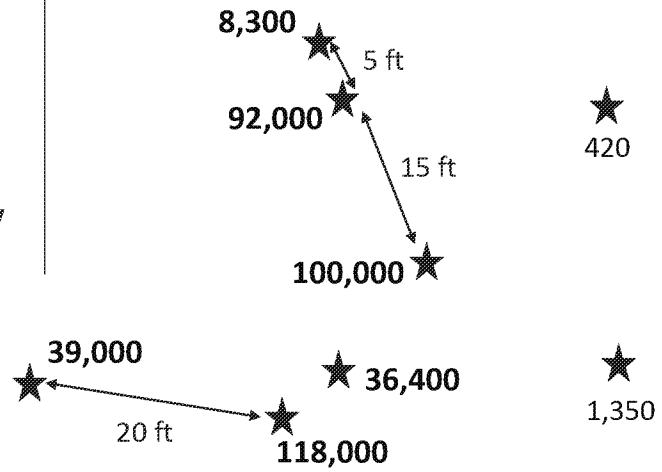


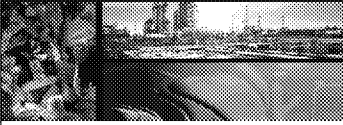


MC-1 Area

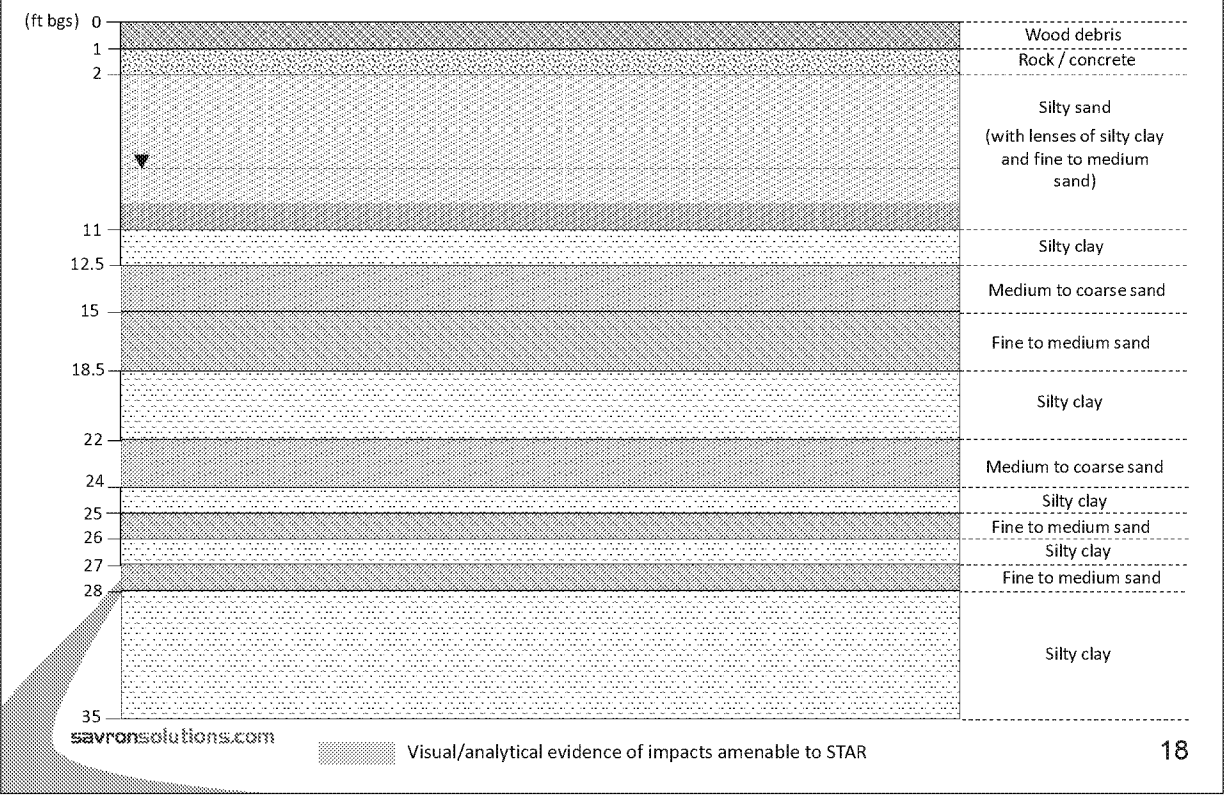
- Higher initial TPH concentrations
- More significant layering of low permeability lenses
- Multiple IP depths may be required

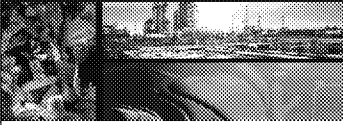
Maximum Total TPH Concentrations (mg/kg)



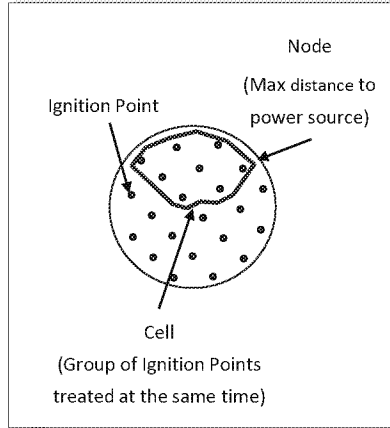


MC-1 Area





Full-Scale Implementation Concept



Treatment Area

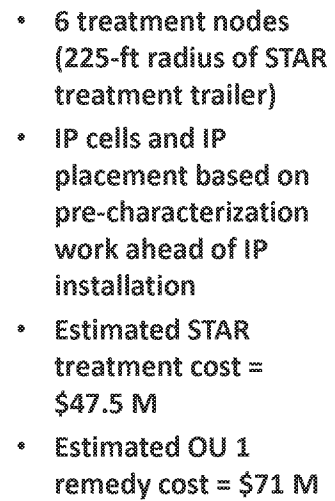
420,865 ft²

STAR Implementation

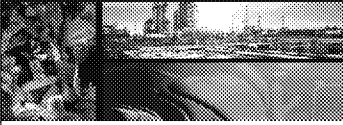
- 2,740 Ignition Points (IPs)
- 8-IP cells
- 14 ft separation (7 ft ROI)

Treatment Timeline

- Propagation rate = 1.4 ft/day
- 3 treatment systems
- 2.5 year operational time



--- STAR Treatment Nodes



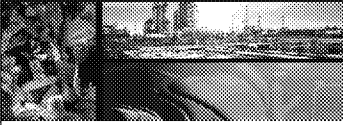
Site Uncertainties/Cost Refinements

Key Site Uncertainties:

- **Spatial variability of contaminant concentrations**
 - Areas within currently defined treatment zone may not need to be targeted for treatment with STAR, so fewer IPs than base case = reduced cost
- **Areal extent of impacts with multiple layers at a given location requiring additional IPs**
 - Additional IPs at a location = increased cost

Cost Refinements:

- **Will consider site uncertainties and construction timeframes (more/fewer concurrent treatment systems)**



Summary

- **Successful treatment and propagation of self-sustaining smoldering front in PDE area**
- **Treatment achieved in multiple sand layers separated by low permeability lenses**
- **Anticipated that similar treatment can be achieved in areas of additional drilling investigation where sufficient initial TPH concentrations are present**
- **Adaptive implementation strategy designed to manage Site uncertainties**



Questions?